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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/598,124	08/18/2006	Isao Sakamoto	P30245	1323

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ART UNIT	**PAPER NUMBER**
1726	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)
	10/598,124	SAKAMOTO ET AL.
	Examiner	Art Unit
	YOSHITOSHI TAKEUCHI	1726

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _2010 September 15_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

5)☒ Claim(s) _1, 9, 11-13, and 15-28_ is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) _1, 9, 11-13, and 15-28_ is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on _2006 August 16_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

12)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. Claims 1, 9, 11-13, and 15-28, wherein claims 1, 9, and 11-12 are currently amended; and claims 19-28 are newly added. Claims 2-8, 10, and 14 are cancelled.

2. The prior 35 U.S.C. §103(a) rejections of claims 1-18 are withdrawn as a result of the arguments and cancellation of said claims.

Continued Examination Under 37 CFR 1.114

3. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 15, 2010 has been entered.

Claim Objections

4. Claim 9 is objected to because it depends from now cancelled claim 8. Appropriate correction is required. For purposes of examination, the examiner treats claim 9 to depend from claim 1.

Claim Rejections - 35 USC § 112

5. Claims 1, 9, 11-13, and 15-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

6. Claim **1**, from which claims 9 and 11-12 depend, **15**, and **17** includes the limitation "uniform" in "uniform mixture" and "uniform thickness," but there is not sufficient guidance in the instant specification to determine the metes and bounds of said limitation. For example, the

specification teaches "<u>even if the solder particles precipitate</u> in the liquid substance…the solder particles are uniformly dispersed in the liquid substance" (¶0021, emphasis added).

7. Claim **13**, from which claims 15-16 depends, include the limitation "close" in "close to the melting point of the solder particles," but there is not sufficient guidance in the instant specification to determine the metes and bounds of said limitation.

8. Claims **1**, from which claims 9 and 11-12 depend, includes the limitation "which reacts at a melting point of the solder particles" in "a liquid substance is a fatty acid ester and comprises a flux component which reacts at a melting point of the solder particles." The limitation could be interpreted to refer to the liquid substance, a fatty acid ester, or a flux component. For purposes of examination, the limitation is interpreted to refer to any of the three.

Still regarding claim **1**, it is unclear whether "and comprises a flux component" in "the liquid substance is a fatty acid ester and comprises a flux component" refers to the liquid substance or fatty acid ester. For purposes of examination, the limitation is interpreted to refer to either.

9. Regarding claim **1**, from which claims 9 and 11-12 depend, **13**, from which claims 15-16 depend, **17,** and **18**, it is unclear what the limitation "deposits in layers on a base material" modifies, whether it modifies the mixture that is capable of depositing in layers or the viscosity is one that flows at room temperature and further allows for deposition in layers. For purposes of examination, the limitation is interpreted to refer to either.

10. Claim **13**, from which claims 15-16 depend, and **18** includes the limitation "whose [sic] reaction temperature is close to the melting point of the solder particles" in "a mixture of solder particles and a liquid substance with flux component whose [sic] reaction temperature is close to

the melting point of the solder particles." The limitation could be interpreted to refer to the liquid substance or a flux component. For purposes of examination, the limitation is interpreted to refer to either.

Double Patenting

11. Claims **27-28** are objected to under 37 CFR 1.75 as being a substantial duplicate of claims 21-22 respectively. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. The factual inquiries set forth in Graham v. John Deere Co., 383 U.S. 1 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

14. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

COMPOSITION

15. Claims 17,19 and 23-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (Lee, Reflow Soldering Processes and Troubleshooting SMT, BGA, CSP and Flip Chip Technologies 37-54 (2002)).

a. Regarding independent claim **17**, Lee teaches a solder paste composition made of solder powder and a flux (37:1, wherein it is understood that the flux is a liquid, since the paste has a “creamy nature” and is a vehicle for the soldering powder, resulting in a stable suspension; and the solder particles are “granular agents,” since “particles” reads on “granules”); wherein the paste is a blend of the solder powder and flux (45:2, which is expected to be a “uniform mixture”).

Lee teaches the flux needs to simultaneously perform a number of important functions at the same time, such as promote thermal transfer to the area of the solder joint, enhance wetting of the solder on the base metal, and prevent oxidation of the metal surfaces at the soldering temperatures (37:2). Lee teaches the flux may be a variety of

chemicals, which includes organic acids (37:3), where the reaction occurs at the soldering temperature (i.e. "reacts at a melting point of the solder particles").

Lee does not expressly teach the claimed limitations of "a mixing ratio and a particle diameter to be uniformly dispersible within the liquid substance" or "the particle diameter of the solder particles is 35 μm or less." However, Lee teaches the mixing volume ratio of solder particles to the solder paste affects the viscosity and the solder particle volume% is proportionate to the weight% of solder particles (53:4 plus Figure 3.10 and 3.29), wherein the solder paste needs to have a low viscosity during deposition (52:4). Lee further teaches "the size of the solder particle also plays a significant role in rheology. Figure 3.31 shows the viscosity increases with decreasing powder size" (54:3). As a result, since Lee teaches the mixing ratio of solder power in weight percent and the size of the solder particles also affects the viscosity, the mixing ratio and particle sizes are result effective variables of viscosity, an important characteristic during deposition, so it would have been obvious to optimize the mixing ratio of the solder power and the solder particle sizes in the claimed weight% ranges. MPEP § 2144.05(II).

In the alternative, Lee teaches a solder paste composition with 0 vol% and near 0 vol% particles (Figure 3.29), which corresponds to a weight% of below 20 wt% (See Figure 3.10), which provides low viscosity (Figure 3.29), wherein the solder paste needs to have a low viscosity during deposition (52:4). As a result, it would have been obvious to use a solder composition with near 0 wt% solder particles in order to have low viscosity during deposition, which is within the instantly claimed range of "less than or equal to 30 wt%." MPEP § 2144.05(I).

<u>In the alternative</u>, Lee teaches the particle diameter of the solder particles may be 400-500 mesh size (44:3), which is 20-38 μm (Table 3.12), overlapping the claimed range of "35 μm or less." MPEP § 2144.05(I).

The limitation "mixed…at room temperature" in "the solder particles are mixed in the liquid substance at room temperature" does not patentably distinguish the inventions, since this is a process step within a product claim. MPEP § 2113. Here, Lee teaches the solder particles and flux are blended (45:3).

<u>In the alternative</u>, Lee teaches the solder powder and flux are blended, but does not teach during heating or cooling, so impliedly teaches the mixing is at room temperature.

Lee does not expressly teach the claimed limitation of "the mixture of the liquid substance and solder particles has a viscosity that flows at room temperature." However, Lee teaches the viscosity affects the printing performance of solder paste, which is optimized depending on the flux chemistry (53:1 and e.g. Figure 3.27). As a result, it would have been obvious to a person of ordinary skill in the art to optimize the viscosity so that it flows at room temperature, since Lee teaches the viscosity affects the printing performance of the paste.

Lee as modified does not expressly teach limitations "the mixture of the liquid substance and solder particles deposits in layers on a base material" and "solder particles precipitate in the liquid substance towards the base material." However, said limitations do not patentably distinguish the inventions, since these are steps in a process of using the mixture within a product claim. MPEP § 2113.

In the alternative, the mixture is a substantially similar composition (see *supra*), so would be expected to deposit in layers. MPEP § 2112.01.

b. Regarding independent claim **19**, Lee teaches a solder paste composition ***consisting essentially of*** solder powder and a flux (37:1, wherein it is understood that the flux is a liquid, since the paste has a "creamy nature" and is a vehicle for the soldering powder, resulting in a stable suspension). Nothing in the claim requires the liquid substance to be different from the flux, and the liquid substance may be the same as the flux, as noted in claims 26 and 28.

c. Regarding claims **23-25**, the flux component is optional, and therefore not required.

16. Claims 1 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (Lee, Reflow Soldering Processes and Troubleshooting SMT, BGA, CSP and Flip Chip Technologies 37-54 (2002)) in view of Mallon et al (US 2002/0187264).

d. Regarding independent claim **1**, Lee teaches a solder paste composition made of solder powder and a flux (37:1, wherein it is understood that the flux is a liquid, since the paste has a "creamy nature" and is a vehicle for the soldering powder, resulting in a stable suspension; and the solder particles are "granular agents," since "particles" reads on "granules"); wherein the paste is a blend of the solder powder and flux (45:2, which is expected to be a "uniform mixture").

Lee does not expressly teach the claimed limitations of “the mixing ratio of the solder particles is less than or equal to 30wt%” or “a mixing ratio and a particle diameter to be uniformly dispersible within the liquid substance.”

However, Lee teaches the mixing volume ratio of solder particles to the solder paste affects the viscosity and the solder particle volume% is proportionate to the weight% of solder particles (53:4 plus Figure 3.10 and 3.29), wherein the solder paste needs to have a low viscosity during deposition (52:4). Lee further teaches “the size of the solder particle also plays a significant role in rheology. Figure 3.31 shows that the viscosity increases with decreasing powder size” (54:3). As a result, since Lee teaches the mixing ratio of solder power in weight percent and the size of the solder particles also affects the viscosity, the mixing ratio and particle sizes are result effective variables of viscosity, an important characteristic during deposition, so it would have been obvious to optimize the mixing ratio of the solder power and the solder particle sizes in the claimed weight% ranges. MPEP § 2144.05(II).

In the alternative, Lee teaches a solder paste composition with 0 vol% and near 0 vol% particles (Figure 3.29), which corresponds to a weight% of below 20 wt% (See Figure 3.10), which provides low viscosity (Figure 3.29), wherein the solder paste needs to have a low viscosity during deposition (52:4). As a result, it would have been obvious to use a solder composition with near 0 wt% solder particles in order to have low viscosity during deposition, which is within the instantly claimed range of "less than or equal to 30 wt%.” MPEP § 2144.05(I).

The limitation "mixed…at room temperature" in "the solder particles are mixed in the liquid substance at room temperature" does not patentably distinguish the inventions, since this is a process step within a product claim. MPEP § 2113. Here, Lee teaches the solder particles and flux are blended (45:3).

In the alternative, Lee teaches the solder powder and flux are blended, but does not teach during heating or cooling, so impliedly teaches the mixing is at room temperature.

Lee does not expressly teach the claimed limitation of "the mixture of the liquid substance and solder particles has a viscosity that flows at room temperature." However, Lee teaches the viscosity affects the printing performance of solder paste, which is optimized depending on the flux chemistry (53:1 and e.g. Figure 3.27). As a result, it would have been obvious to a person of ordinary skill in the art to optimize the viscosity so that it flows at room temperature, since Lee teaches the viscosity affects the printing performance of the paste.

Lee teaches the flux needs to simultaneously perform a number of important functions at the same time, such as promote thermal transfer to the area of the solder joint, enhance wetting of the solder on the base metal, and prevent oxidation of the metal surfaces at the soldering temperatures (37:2). Lee teaches the flux may be a variety of chemicals, which includes organic acids (37:3), where the reaction occurs at the soldering temperature (i.e. "reacts at a melting point of the solder particles"), but does not expressly teach the liquid is a "fatty acid ester." However, Mallon teaches a soldering flux vehicle for fine pitch printing that improves release from a stencil by including a lubricant

additive in the solder paste (¶0006), an important property, since as features in electronics shrink, the tackiness of the soldering paste, while important for placing components in a position, prevents clean printing (¶¶ 0004-05). A variety of lubricants can be used, including fatty acid esters (¶0018).

As a result, it would have been obvious to a person of ordinary skill in the art to use the fatty acid esters of Mallon in the soldering paste of Lee, in order to improve the release of the soldering paste from the stencil, resulting in improved printing quality of the soldering paste.

Lee as modified does not expressly teach limitations “the mixture of the liquid substance and solder particles deposits in layers on a base material” and “solder particles precipitate in the liquid substance towards the base material." However, said limitations do not patentably distinguish the inventions, since these are steps in a process of using the mixture within a product claim. MPEP § 2113.

In the alternative, the mixture is a substantially similar composition (see supra), so would be expected to deposit in layers. MPEP § 2112.01.

In the alternative if Lee is interpreted to not teach the limitation “reacts at a melting point of the solder particles,” said property would be expected in Lee as modified, since the solder paste has substantially the same composition. MPEP § 2112.01.

e. Regarding claim **9**, Lee as modified teaches the composition of claim 1, wherein the flux component is a free fatty acid contained in the fat liquid substance, since nothing within the claim requires the flux component to be different from the fat liquid substance.

17. Claims 20-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (Lee, Reflow Soldering Processes and Troubleshooting SMT, BGA, CSP and Flip Chip Technologies 37-54 (2002)), as provided *supra*, and further in view of Mallon et al (US 2002/0187264) and Niedzielski (Niedzielski, <u>Neopentyl Polyol Ester Lubricants—Bulk Property Optimization</u>, 54-58 Ind. Eng. Chem., Prod. Res. Dev. 15 (1976)).

Regarding claims **20-28**, Lee teaches the composition of claim 19, as provide *supra*, wherein Lee teaches the flux may be a variety of chemicals, which includes organic acids (37:3), where the reaction occurs at the soldering temperature (i.e. “reacts at a melting point of the solder particles”), but does not expressly teach “the liquid substance is a fat;” “the fat is fatty acid ester; “the fatty acid ester is neopentylpolyolester;” “a flux component that is an acid;” “the flux component is an organic acid;” “the flux component is a fatty acid;” “the liquid substance is a fat and the solder composition includes the flux component, which is a fatty acid;” “the fat is a fatty acid ester;" or “the fatty acid ester is neopentylpolyolester.”

However, Niedzielski teaches neopentylpolyolester is an organic ester with varying amounts of carboxylic acid functional groups used as a lubricant in the aviation industry and has flexible properties, which can be adjusted by changing the chemistry of the starting materials (54:1-4).

Furthermore, Mallon teaches a soldering flux vehicle for fine pitch printing that improves release from a stencil by including a lubricant additive in the solder paste (¶0006), an important property, since as features in electronics shrink, the tackiness of the soldering paste, while

important for placing components in a position, prevents clean printing (¶¶ 0004-05). A variety of lubricants can be used, including fatty acid esters (¶0018).

As a result, it would have been obvious to a person of ordinary skill in the art to use the fatty acid esters of Mallon in the soldering paste of Lee, in order to improve the release of the soldering paste from the stencil, resulting in improved printing quality of the soldering paste' and furthermore, to use the neopentylpolyolester of Niedzielski as the lubricant in Lee as modified, since Niedzielski teaches neopentylpolyolester is a lubricant in the aviation industry (implying it is well characterized) and has flexible properties, which can be tailored to the soldering paste.

18. Claims 11-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (Lee, Reflow Soldering Processes and Troubleshooting SMT, BGA, CSP and Flip Chip Technologies 37-54 (2002)) in view of Mallon et al (US 2002/0187264), as provided *supra*, and further in view of Niedzielski (Niedzielski, <u>Neopentyl Polyol Ester Lubricants—Bulk Property Optimization</u>, 54-58 Ind. Eng. Chem., Prod. Res. Dev. 15 (1976)).

Regarding claims **11-12**, Lee as modified teaches the composition of claim 1, as provided *supra*, but does not expressly teach the fatty acid ester is neopentylpolyolester. However, Niedzielski teaches neopentylpolyolester is an organic ester with varying amounts of carboxylic acid functional groups used as a lubricant in the aviation industry and has flexible properties, which can be adjusted by changing the chemistry of the starting materials (54:1-4). As a result, it would have been obvious to a person of ordinary skill in the art to use the neopentylpolyolester of Niedzielski as the lubricant in Lee as modified, since Niedzielski teaches neopentylpolyolester is a lubricant in the aviation industry (implying it is well characterized) and has flexible properties, which can be tailored to the soldering paste.

*Still regarding claim **12***, Lee as modified does not expressly teach "an acid value of the fatty acid ester is greater than or equal to one." However, since Lee as modified teaches the use of neopentylpolyolester is a lubricant (see *supra*), said property would be expected, since it is the same composition (neopentylpolyolester). MPEP § 2112.01(I) and see also instant specification ¶0017, which teaches "the acid value is the amount in milligrams of potassium hydroxide necessary for neutralizing the free fatty acid contained in the fat and fatty oil 1g," and the liquid includes neopentylpolyolester.

METHOD

19. Claims 13 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (Lee, Reflow Soldering Processes and Troubleshooting SMT, BGA, CSP and Flip Chip Technologies 37-54 (2002)).

f. Regarding claim **13**, Lee suggests a method of forming bumps (54:4) comprising (a) depositing a solder paste (e.g. 48:1, which implies the deposition is on a base material), wherein the solder paste comprises solder powder and a flux (37:1, wherein it is understood that the flux is a liquid, since the paste has a "creamy nature" and is a vehicle for the soldering powder, resulting in a stable suspension), wherein the flux may be a variety of chemicals, which includes organic acids (37:3), where the reaction occurs at the soldering temperature (i.e. "flux component whose reaction temperature is close to the melting point of the solder particles"); wherein the paste is made by blending the solder powder and flux (45:2, which is expected to be a "uniform mixture," reading on the limitation "wherein the solder particles are uniformly dispersed in the liquid substance by stirring the solder composition in a pre-stage of the deposition;" and *in the*

alternative, the limitation “wherein the solder particles are uniformly dispersed in the liquid substance by stirring the solder composition in a pre-stage of the deposition” is not an actively recited step, so does not patentably distinguish the method claims from the art of record.); (b) reflow step for heating the solder composition (37:1); and, (c) forming bumps made up of solder particles on the base material (54:7).

Lee does not expressly teach the claimed limitations of “solder particles…that have a mixing ratio and a particle diameter to be uniformly dispersible within the liquid substance” or “the mixing ratio of the solder particles is less than or equal to 30wt%.” However, Lee teaches the mixing volume ratio of solder particles to the solder paste affects the viscosity and the solder particle volume% is proportionate to the weight% of solder particles (53:4 plus Figure 3.10 and 3.29), wherein the solder paste needs to have a low viscosity during deposition (52:4). Lee further teaches “the size of the solder particle also plays a significant role in rheology. Figure 3.31 shows that the viscosity increases with decreasing powder size” (54:3). As a result, since Lee teaches the mixing ratio of solder power in weight percent and the size of the solder particles also affects the viscosity, the mixing ratio and particle sizes are result effective variables of viscosity, an important characteristic during deposition, so it would have been obvious to optimize the mixing ratio of the solder power and the solder particle sizes within the claimed limitations. MPEP § 2144.05(II).

In the alternative, Lee teaches a solder paste composition with 0 vol% and near 0 vol% particles (Figure 3.29), which corresponds to a weight% of below 20 wt% (See Figure 3.10), which provides low viscosity (Figure 3.29), wherein the solder paste needs

to have a low viscosity during deposition (52:4). As a result, it would have been obvious to use a solder composition with near 0 wt% solder particles in order to have low viscosity during deposition, which is within the instantly claimed range of "less than or equal to 30 wt%." MPEP § 2144.05(I).

Lee does not expressly teach the claimed limitation of “the solder composition having a viscosity that flows at normal temperature and that deposits in layers on a base material.” However, Lee teaches the viscosity affects the printing performance of solder paste, which is optimized depending on the flux chemistry (53:1 and e.g. Figure 3.27). As a result, it would have been obvious to a person of ordinary skill in the art to optimize the viscosity so that it flows at normal temperature and deposits in layers on a base material, since Lee teaches the viscosity affects the printing performance of the paste.

In the alternative, the mixture is a substantially similar composition (see *supra*), so would be expected to deposit in layers. MPEP § 2112.01.

Lee does not expressly teach the claimed limitation of “solder particles that precipitate through the liquid substance towards the base material.” However, the mixture is a substantially similar composition (see *supra*), so would be expected to deposit in layers. MPEP § 2112.01.

In the alternative, step (a), “deposition for depositing on a base material a solder composition comprising a mixture of solder particles and a liquid substance with flux component whose reaction temperature is close to the melting point of the solder particles, the solder composition having a viscosity that flows at normal temperature and that deposits in layers on a base material, and solder particles that precipitate through the

liquid substance towards the base material and that have a mixing ratio and a particle diameter to be uniformly dispersible within the liquid substance," is not a positively recited step within the claimed method. As a result, it does not patentably distinguish the instant invention from the art.

g. Regarding claim **18**, Lee suggests a method of forming bumps (54:4) comprising (a) depositing a solder paste (e.g. 48:1, which implies the deposition is on a base material), wherein the solder paste comprises solder powder and a flux (37:1, wherein it is understood that the flux is a liquid, since the paste has a "creamy nature" and is a vehicle for the soldering powder, resulting in a stable suspension), wherein the flux may be a variety of chemicals, which includes organic acids (37:3), where the reaction occurs at the soldering temperature (i.e. "flux component whose reaction temperature is close to the melting point of the solder particles"); and, (b) reflow step for heating the solder composition and forming bumps made up of solder particles on the base material (37:1).

Lee does not expressly teach the claimed limitations of "a mixing ratio and a particle diameter to be uniformly dispersible within the liquid substance" or "the particle diameter of the solder particles is 35 μm or less." However, Lee teaches the mixing volume ratio of solder particles to the solder paste affects the viscosity and the solder particle volume% is proportionate to the weight% of solder particles (53:4 plus Figure 3.10 and 3.29), wherein the solder paste needs to have a low viscosity during deposition (52:4). Lee further teaches "the size of the solder particle also plays a significant role in rheology. Figure 3.31 shows that the viscosity increases with decreasing powder size" (54:3). As a result, since Lee teaches the mixing ratio of solder power in weight percent

and the size of the solder particles also affects the viscosity, the mixing ratio and particle sizes are result effective variables of viscosity, an important characteristic during deposition, so it would have been obvious to optimize the mixing ratio of the solder power and the solder particle sizes in the claimed weight% ranges. MPEP § 2144.05(II).

In the alternative, Lee teaches a solder paste composition with 0 vol% and near 0 vol% particles (Figure 3.29), which corresponds to a weight% of below 20 wt% (See Figure 3.10), which provides low viscosity (Figure 3.29), wherein the solder paste needs to have a low viscosity during deposition (52:4). As a result, it would have been obvious to use a solder composition with near 0 wt% solder particles in order to have low viscosity during deposition, which is within the instantly claimed range of "less than or equal to 30 wt%." MPEP § 2144.05(I).

In the alternative, Lee teaches the particle diameter of the solder particles may be 400-500 mesh size (44:3), which is 20-38 μm (Table 3.12), overlapping the claimed range of "35 μm or less." MPEP § 2144.05(I).

Lee does not expressly teach the claimed limitation of "the solder composition having a viscosity that flows at normal temperature and that deposits in layers on a base material." However, Lee teaches the viscosity affects the printing performance of solder paste, which is optimized depending on the flux chemistry (53:1 and e.g. Figure 3.27). As a result, it would have been obvious to a person of ordinary skill in the art to optimize the viscosity so that it flows at normal temperature and deposits in layers on a base material, since Lee teaches the viscosity affects the printing performance of the paste.

In the alternative, the mixture is a substantially similar composition (see *supra*), so would be expected to deposit in layers. MPEP § 2112.01.

Lee does not expressly teach the claimed limitation of "solder particles that precipitate through the liquid substance towards the base material." However, the mixture is a substantially similar composition (see *supra*), so would be expected to deposit in layers. MPEP § 2112.01.

20. Claims 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (Lee, Reflow Soldering Processes and Troubleshooting SMT, BGA, CSP and Flip Chip Technologies 37-54 (2002)), as provided *supra*, and further in view of Wittmann (US 3,359,132).

h. Regarding claim **15**, Lee teaches the method of claim 13, as provided *supra*, but does not expressly teach "the solder composition is spin coated to a uniform thickness by rotating the base material in the deposition step." However, Wittman teaches one deposition method is to dip the substrate into solder and spin the substrate, which results in a uniform and smooth finish of the solder paste (2:16-17 and 31-32).

As a result, it would have been obvious to a person of ordinary skill in the art to deposit solder paste using a spin step in the method of Lee in order to provide a uniform smooth finish.

i. Regarding claim **16**, Lee teaches the method of claim 13, as provided *supra*, but does not expressly teach "the solder composition is poured into a container arranged with the base material, and the base material is immersed in the solder composition in the deposition step." However, Wittmann teaches one deposition method is to dip the substrate into solder contained in a container and spin the substrate, which results in a

uniform and smooth finish of the solder paste (2:16-17 and 31-32 plus Figure 1, wherein solder is contained in item 44).

As a result, it would have been obvious to a person of ordinary skill in the art to deposit solder paste using a dip then spin step in the method of Lee in order to provide a uniform smooth finish.

Lee as modified suggests pouring the solder composition in the container first (since the solder composition is contained in item 44 of Figure 1), then dipping the base material, as provided *supra*, but does not teach placing the base material into the container first, then pouring the solder paste. However, steps out of order are *prima facie* obvious. MPEP § 2144.04(IV)(C).

In the alternative, it would have been obvious to place the base material in the container first, then pour the solder paste, in order to minimize the complexity of moving mechanism during the coating step.

Response to Arguments

21. Applicant's arguments with respect to claims 1, 9, 11-13, and 15-28 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

22. Any inquiry concerning this communication or earlier communications from the examiner should be directed to YOSHITOSHI TAKEUCHI whose telephone number is (571)270-5828. The examiner can normally be reached on Monday-Thursday 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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